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## PATENT COOPERATION TREATY

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PCT

## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 18984/129790		<b>FOR FURTHER ACTION</b> See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/US01/19920	International filing date (day/month/year) 25/06/2001	Priority date (day/month/year) 26/06/2000	
International Patent Classification (IPC) or national classification and IPC C02F1/00			
Applicant MARINE DESALINATION SYSTEMS, L.L.C. et al.			
<p>1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of 9 sheets, including this cover sheet.</p> <p><input checked="" type="checkbox"/> This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).</p> <p>These annexes consist of a total of 2 sheets.</p>			
<p>3. This report contains indications relating to the following items:</p> <ul style="list-style-type: none"><li>I <input checked="" type="checkbox"/> Basis of the report</li><li>II <input type="checkbox"/> Priority</li><li>III <input type="checkbox"/> Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</li><li>IV <input checked="" type="checkbox"/> Lack of unity of invention</li><li>V <input checked="" type="checkbox"/> Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</li><li>VI <input type="checkbox"/> Certain documents cited</li><li>VII <input type="checkbox"/> Certain defects in the international application</li><li>VIII <input type="checkbox"/> Certain observations on the international application</li></ul>			
Date of submission of the demand 14/12/2001		Date of completion of this report 30.10.2002	
Name and mailing address of the international preliminary examining authority:  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465		Authorized officer Borello, E Telephone No. +49 89 2399 7378	



# INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/US01/19920

## I. Basis of the report

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17)*):

**Description, pages:**

1-47 as originally filed

**Claims, No.:**

1-5,6 (part) as originally filed

6 (part),7-14 as received on 09/08/2002 with letter of 07/08/2002

**Drawings, sheets:**

1/27-27/27 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT**

International application No. PCT/US01/19920

- ☐ the description, pages:  
☒ the claims, Nos.: 15  
☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

*(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)*

6. Additional observations, if necessary:

**IV. Lack of unity of invention**

1. In response to the invitation to restrict or pay additional fees the applicant has:

- ☐ restricted the claims.  
☒ paid additional fees.  
☐ paid additional fees under protest.  
☐ neither restricted nor paid additional fees.

2. ☐ This Authority found that the requirement of unity of invention is not complied and chose, according to Rule 68.1, not to invite the applicant to restrict or pay additional fees.

3. This Authority considers that the requirement of unity of invention in accordance with Rules 13.1, 13.2 and 13.3 is

- ☐ complied with.  
☐ not complied with for the following reasons:

4. Consequently, the following parts of the international application were the subject of international preliminary examination in establishing this report:

- ☒ all parts.  
☐ the parts relating to claims Nos. .

**V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

1. Statement

Novelty (N) Yes: Claims 1-14  
No: Claims

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT**

International application No. PCT/US01/19920

Inventive step (IS)	Yes:	Claims	1-8,13,14
	No:	Claims	9-12
Industrial applicability (IA)	Yes:	Claims	1-14
	No:	Claims	

2. Citations and explanations  
**see separate sheet**

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT - SEPARATE SHEET**

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International application No. PCT/US01/19920

**Re Item IV**

**Lack of unity of invention**

1. This IPEA confirms the opinion of the ISA, that found that this international application does not comply with the requirements of unity of invention in terms of Art. 3(4)(iii)PCT and Rule 13(1)-(2)PCT.

2. The multiple (groups of) inventions can be grouped as follows:

1. Invention: claims 1-8.

An installation for desalinating or purifying saline or otherwise polluted input water comprising: a desalination fractionation installation having a lower, hydrate formation region, an input water conduit and a gas supply conduit, and an upper hydrate dissociation region. The special technical feature is that the hydrate dissociation region is artificially pressurized and that this pressure combined with the natural pressurization is used to create pressurization suitable for the spontaneous formation of hydrate in the hydrate formation region.

2. Invention: claims 9-14

An installation for desalinating or purifying saline or otherwise polluted input water comprising: a desalination fractionation installation having a lower, hydrate formation region, an input water conduit and a gas supply conduit, and an upper hydrate dissociation region. The special technical feature is that the input water is at least partially cooled by being passed through the dissociation region in heat exchanging relationship with the dissociation region where the hydrates dissociate endothermically.

3. The technical common feature to inventions 1 and 2 is the installation for desalinating or purifying saline or otherwise polluted input water comprising: a desalination fractionation installation having a lower, hydrate formation region, an input water conduit and a gas supply conduit, and an upper hydrate dissociation region.

This technical common feature is already known (cf. US-A-5 873 262).

Since no common or corresponding special technical features are present

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/US01/19920

between the above two groups of inventions, the requisite unity of invention is not fulfilled and the application does not comply with the requirements of Art. 3(4)(iii) PCT and Rule 13(1-2) PCT (i.e. that the application shall relate to one invention only or to a group of inventions so linked as to form a single general inventive concept).

**Re Item V**

**Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

**1. First Invention: claims 1-8**

**1.1 Reference is made to the following documents:**

D1: US-A-5 873 262 (PELLENBARG ROBERT E ET AL) 23 February 1999

D2: US-A-5 553 456 (MCCORMACK RICHARD A) 10 September 1996

D3: US-A-2 904 511 (DONATH WILM E) 15 September 1959

1.2 D1 and D2 disclose installations for desalination having a desalination fractionation installation with a lower hydrate formation region with an input water conduit and a gas supply conduit and an upper hydrate dissociation region. The formation of the hydrate is only due to natural pressurization (the depth of the ocean), the dissociation region is not under pressure. D3 discloses an installation for desalination in which both the formation and dissociation regions are artificially pressurized.

1.3 Claim 1 differs from the available prior art in that the dissociation region is artificially pressurized and the formation of the hydrate is due to a combination of artificial and natural pressure. The subject-matter of claim 1 is therefore novel (Article 33(2) PCT).

1.4 The problem to be solved by the invention of claim 1 is to provide a desalination installation allowing desalination having a shorter shaft. The solution to this problem proposed in claim 1 of the present application is considered as involving an inventive step (Article 33(3) PCT) for the following reasons:  
The solution is the pressurization of the dissociation region and the combination of



**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT - SEPARATE SHEET**

---

International application No. PCT/US01/19920

this pressure with the natural pressure in the ocean.

D1 and D2 do not disclose or suggest artificial pressurization. In D3 the whole process is done above sea level, thus it is entirely artificially pressurized. However, there is no hint to combine these documents, neither of these documents are concerned with the technical problem nor is there a suggestion how to solve this problem.

- 1.5 Claims 2-8 are dependent on claim 1 and as such also meet the requirements of the PCT with respect to novelty and inventive step.

**2. Second Invention: claims 9-14**

- 2.1. Reference is made to the following document:

D4: PATENT ABSTRACTS OF JAPAN vol. 2000, no. 02, 29 February 2000 & JP 11 319805 A (KANSAI SHINGIJUTSU KENKYUSHO:KK), 24 November 1999  
The English translation can be found under the Internet address [www4.ipdl.jp-omiti.go.jp](http://www4.ipdl.jp-omiti.go.jp)

- 2.2 D4 discloses an installation for desalinating sea or raw water, said installation comprising: a desalination fractionation installation having a hydrate formation region, an input water conduit and a gas supply conduit for the hydrate formation region and a hydrate dissociation region. Sea water is at least partially cooled by being passed through the dissociation region (Items 40-44) in a heat exchanging relationship with the dissociation region, whereby heat absorbed from said input water as hydrate located in the dissociation region dissociates endothermically.
- 2.3 Claim 9 differs from the available prior art D4 in that the hydrate dissociation region comprises a plurality of cooling elements in heat exchanging relationship with the input sea water. The subject-matter of claim 9 is therefore novel (Article 33(2) PCT).
- 2.4 The problem to be solved by the invention of claim 9 seems to be how to improve

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT - SEPARATE SHEET**

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International application No. PCT/US01/19920

the heat exchanging relationship in the dissociation region.

The solution to this problem seems to be an installation allowing a more precise control of the temperature distribution of the input water and of the heat requirements of the dissociation reaction.

Whilst claim 9 defines a plurality of cooling elements, it seems that the technical problem as posed above can only be solved effectively by the invention of claim 13 which is defined by all the essential features (Art. 6 PCT together with PCT Gazette-Section IV, Chapter III-4.4).

For this reasons claim 13 is considered as involving an inventive step (Article 33(3) PCT).

- 2.5 Claim 14 is dependent on claim 13 and as such also meets the requirements of the PCT with respect to novelty and inventive step.
3. The document WO0104056-A cited in the international search report is not relevant for the PCT examination. It will be considered and properly evaluated during the regional or national phases.
4. Deficiencies objected to under the provisions of Art. 6 PCT
- 4.1 The following discrepancies between the description and the figures have been noticed:
- 4.1.1 In figure 2 reference sign 59 should be deleted since it seems to be superfluous (reference sign 59 is already describing fixed column above in figure 4). In addition, reference sign 40 (page 11, line 3) describing the sump is missing in figure 2.
- 4.1.2 Reference sign 44 in figure 4 should be changed to reference sign 44' (see page 11, line 19).
- 4.1.3 Reference sign 372 describing the discharge point of the pumped sunken hydrate into the heat exchange and dissociation chamber 350 in figure 8 (page 20, line 4) is missing in figure 8. On the other hand, reference sign 360 can be found twice in figure 8 and it seems that the lower one (beside inlet

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT - SEPARATE SHEET**

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International application No. PCT/US01/19920

point 352) should be deleted.

- 4.1.4 In figure 12 reference sign 410 seems to describe the fluid removal section which however has reference sign 44 in the description (page 22, line 3).
- 4.1.5 In figure 16 reference sign 850 seems to be superfluous. In addition, reference sign 740 (outlet of residue water) does not figure in the description (pages 28-29).
- 4.1.6 In figure 17 reference sign 811 (valve?) does not figure in the description.
- 4.1.7 In figure 18 reference sign 910 (pumps?) is not described in the description (pages 30-31).
- 4.1.8 Reference sign 1409 in figure 27 does not figure in the description.
- 4.2. The units "atmospheres" (page 18, lines 13-15; page 38, lines 15-22; page 39, line 5; page 40, line 31) and "cc" (page 34, lines 8+9) are not additionally expressed in terms of the units stipulated by Rule 10.1(a) PCT.
- 4.3 The enlarging statement in the description on page 47 lines 7-10 implies that the subject-matter for which protection is sought may be different to that defined by the claims, thereby resulting in lack of clarity (Article 6 PCT) when used to interpret them (see also the PCT Guidelines III-4.3a).
- 5. The expression "incorporated by reference" (description at page 1 lines 29-30) is obviously irrelevant or unnecessary (R. 9.1(iv)PCT).

pressure depth that is approximately equivalent to the pressure which is artificially maintained in the dissociation region of said installation.

7. The installation of claim 1, wherein said hydrate dissociation region is artificially pressurized by the head of the weight of water contained  
5 in the input water conduit.

8. The installation of claim 7, wherein said input water conduit syphons water into the installation creating the artificial pressurization in the dissociation region.

9. An installation for desalinating or purifying saline or otherwise  
10 polluted input water, said installation comprising:

a desalination fractionation installation having a lower, hydrate formation region;

an input water conduit which is arranged to provide input water to said hydrate formation region; and

15 a gas supply conduit which is arranged to provide hydrate-forming gas to said hydrate formation region;

said installation further comprising a hydrate dissociation region disposed at an upper portion of said installation and in fluid communication with said hydrate formation region, said hydrate dissociation region  
20 comprising a plurality of cooling segments in heat exchanging relationship with said input water; and

wherein the input water is at least partially cooled by being passed through said dissociation region in heat exchanging relationship with the dissociation region, whereby heat is absorbed from said input water as hydrate  
25 located in the dissociation region dissociates endothermically.

10. The installation of claim 9, wherein said cooling segments are separated by walls which prevent hydrate from moving laterally from one cooling segment to another.

11. the installation of claim 9, wherein said cooling segments are in fluid communication with the hydrate formation region.

12. The installation of claim 9, wherein said input water is carried in a heat exchanging apparatus which extends laterally across said plurality of cooling segments.

13. The installation of claim 12, wherein said input water becomes progressively cooler as it passes through each cooling segment of said plurality of cooling segments.

14. The installation of claim 13, wherein said input water conduit which is arranged to provide input water to said hydrate formation region after said input water conduit passes through each cooling segment of said plurality of cooling segments.

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